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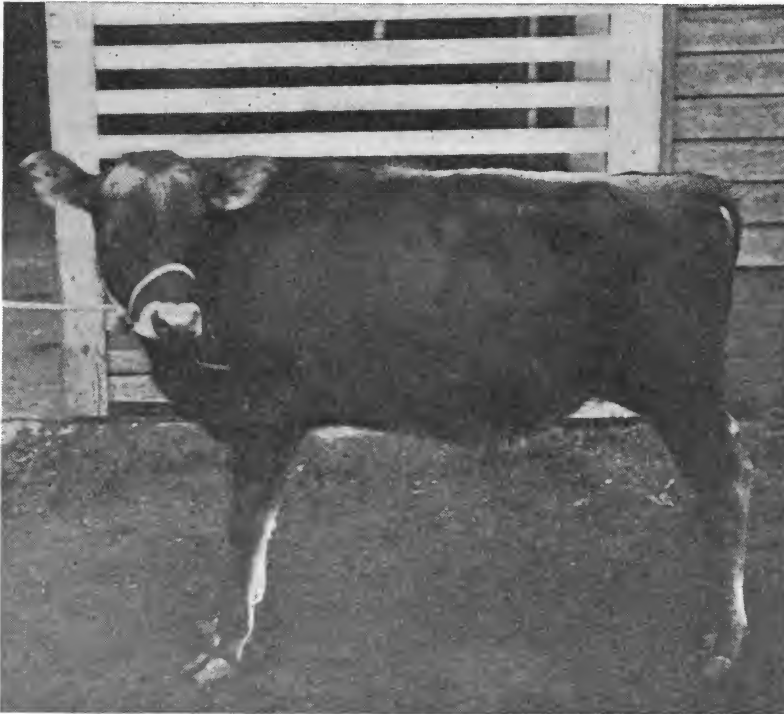
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DAIRY CALVES

CONSUMPTION OF FOOD AND
GAIN BY DIFFERENT BREEDS.

GENERAL NOTES, FEED AND CARE.

By
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INTRODUCTION.

The production of milk is the ground work of all the dairy industry. The amount of and the quality of milk produced determines the extent to which the manufacture of milk products can go on and the amount of milk or milk products that is available for consumption. The amount of milk produced and the economy with which it is produced is determined by the quality, as well as the number, of the cows milked and the quality of the men that are caring for these cows. The number and quality of the cows that are furnishing the milk today was determined by the attention given to the breeding of and care of the calves of yesterday. Likewise, the attention given the calves that are being bred and grown now will determine, to a great extent, the cows that are milked the next few years. In other words, the future of the dairy industry depends to a great extent on the care given to the breeding and developing of the dairy calf. Because of this fact and because we felt the need of more attention to the calf crop in the state, the work outlined in this bulletin was carried out the past winter. This work was planned to determine the relative rate of growth or gain, and the amount of food, grain and hay, that was consumed in making this gain by the calves of the different dairy breeds, under farm conditions. This work has a practical bearing in that it gives an indication as to the amount of grain that should be fed the calves of the different breeds and also the amount of hay that the individuals of the different breeds will use during the first six months of their life. Either or both of these facts might have an influence at times in determining which breed of cows is best suited to certain farm conditions. They indicate that there is a relation between the choice of a breed at times and the available supply of roughage, or grain, or both.

PLAN OF WORK.

For this work the calves of three breeds were available, viz.: Ayrshires, Holsteins, and Jerseys. In selecting the calves the endeavor was made to have the individuals of each breed as near of an age as possible. It was not possible to keep each calf separate, which would have been preferable. The next best plan and the one used was to put the calves of each breed by themselves. This necessitated that the calves of each breed be as near of an age as possible. Four Ayrshires, two Holsteins, and four Jerseys were used. At the time of starting the work, November 27, 1920, there were three Ayrshires available, aged as follows: One, 22 days; one, 20 days; and one, 6 days. Two more were born on November 29, and December 1, respectively, and were placed in the pen when taken from their mothers. The oldest Ayrshire sickened and died in December and allowance was made for this in determining feed records. The rest were normal and quite thrifty.

The two Holsteins were dropped on November 26 and November 27, respectively, and were vigorous all during the trial.

The four Jerseys used were available at the start. At this time they were aged as follows: two, 32 days; one, 24 days; and one, 17 days. They were all vigorous and continued so during the trial. The sex of

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calves might have influenced the amount of grain and hay eaten. The Ayrshires were all bulls, the Holsteins both heifers, while three of the Jerseys were bulls and one a heifer. Usually a bull calf will consume more feed than a heifer.

FEEDING THE CALVES.

In raising the calves the method usually followed at the station was used. The calves were allowed to suck their mothers until two days of age, except in the case of two Jerseys, which were taken away at one day. They were offered milk about 12 hours after being taken from the mother and usually were taught to drink with little difficulty. In case a calf did not drink readily, it was not forced, but was left until the next feeding. This usually gave an appetite that made it take the milk quite readily. The milk of the dam was used for the first seven days and was fed at once after milking. About four pounds, or two quarts, were used at a feed, except in the case of some of the Jerseys which, depending on size and vigor, were started on three or three and one-half lbs., increasing the amount later. This amount was fed twice a day, warm from the cow. Whole milk was fed for the first four weeks, using herd milk after the first week and feeding before it had lost the animal heat. At four weeks a gradual substitution of warm skim milk for the whole milk was begun. In doing this the change was made at the rate of one-half pound at a feed, taking a week to complete the substitution. The amount of milk fed was usually increased at time of changing to skimmilk to four and one-half or five lbs. This increase depended on the size and vigor of the calf. The maximum amount of skimmilk fed was intended, originally, to be five pounds at a feed or ten pounds a day. However, having a liberal supply of milk we increased this to twelve pounds a day toward the end of the trial. The milk was separated and fed at once, while warm.

Grain was kept before the calves from the start. The grain used was a mixture of equal parts of cracked-corn and oats by weight. The calves were allowed all the grain they desired until they were eating an average of two pounds a day. Later the limit of the amount fed was increased to three pounds a day.

Hay was kept in a rack in reach of the calves from the start. They were allowed all the hay they would eat. The best quality of hay on hand was used and was Johnson grass with a sprinkling of alfalfa. The hay was weighed out to each pen and records of these weights recorded.

They had access to water as soon as they would drink it and were allowed all they desired. On bright days they were allowed the run of a small yard.

The calves were weighed at birth and once each week afterwards. Each was weighed on the day it was six months of age. The weighings were taken at the same time of day and as nearly as possible under the same condition each time.

TABLE I—Average Daily Feed and Gain Record by the Week

Period	HOLSTEINS				JERSEYS				AYRSHIRES				ALL BREEDS			
	Milk	Grain	Hay	Ave. Gain	Wks.	Milk	Grain	Hay	Ave. Gain	Wks.	Milk	Grain	Hay	Ave. Gain	Wks.	
1st.	8.	.....	321	.....	7.75	.....	.....	.....	.....	.....	8.	.....	.....	.....	.....
2nd.	8.	.....	32	.93	.....	8.	.....	.....	.....	.....	8.	.....	.....	.014	.064
3rd.	8.	.....	32	.93	.....	8.	.....	.....	.....	.....	8.	.....	.....	.057	.757
4th.	8.	.....	143	.286	.643	.585	8.	.089	.036	.875	.674	8.	.338	.18	1.143
5th.	8.	.....	.....	.....	.....	8.	.32	.339	.036	.875	.674	8.	.2214	.1436	.986
6th.	8.	.....	.....	.....	.....	8.	.75	.....	.....	.....	8.	.....	.....	.2852	.2214
7th.	8.	.....	.....	.....	.....	8.	.75	.....	.....	.....	8.	.....	.....	.2214	1.0812
8th.	8.	.....	.....	.....	.....	8.	.75	.....	.....	.....	8.	.....	.....	.96	.486
9th.	8.	.....	.....	.....	.....	8.	.75	.....	.....	.....	8.	.....	.....	.96	.486
10.	1.39	.....	1.57	1.55	.....	8.	.875	.277	.696	.87	8.5	1.1136	.....	.....	.....
11.	1.7	.....	929.1	664	.....	8.	.75	.468	.697	.....	8.5	1.1136	.....	.....	.....
12.	2.15	2	.....	.....	8.25	1.161	.09	1.178	.....	.....	9.1	1.382	1.213	1.2	1.139
13.	1.85	2.25	2.14	1.1	.....	8.75	1.34	1.68	1.285	.....	9.2	1.566	2.072	1.139	.....
14.	2.03	1.14	1.18	1.473	.....	9.5	1.4	2.14	1.285	1.04	10.1	1.8	2.632	1.178	1.253
15.	2.	3.07	75	.....	.....	10.	1.44	2.61	.946	.....	10.	1.87	3.92	1.249	.....
16.	2.	4.86	1.213	.....	.....	10.	1.34	3.44	1.036	.....	10.	1.92	3.87	1.357	.....
17.	2.	3.64	1.18	.....	.....	10.	1.59	3.66	1.018	.....	10.	1.98	3.87	1.072	.....
18.	2.	5.	1.29	1.258	.....	10.	1.48	3.8	.965	.991	10.	1.95	3.83	.964	1.187
19.	2.	6.2	1.29	.....	.....	10.	1.49	3.65	1.036	.....	10.	1.98	3.68	1.64	.....
20.	2.	4.93	1.64	.....	.....	10.	1.64	3.8	.536	.....	10.	2.	4.02	1.607	.....
21.	2.	6.3	2.2	.....	.....	10.	1.69	3.14	.75	.....	10.	2.	4.51	1.714	.....
22.	2.78	8.07	1.5	1.66	.....	10.	1.78	3.77	.929	.812	10.	2.	5.05	1.107	1.517
23.	2.64	8.43	2.43	.....	.....	10.	1.58	3.33	.643	.....	11.	2.	5.11	1.357	.....
24.	2.35	8.07	.61	.....	.....	10.	1.61	3.98	1.392	.....	11.5	2.	5.11	1.357	.....
25.	2.5	9.57	1.86	.....	.....	10.	1.628	4.19	1.071	.....	11.5	2.	5.11	1.357	.....
26.	2.29	9.1	2.29	1.803	.....	10.	1.628	4.19	1.071	.....	12.	2.2	5.18	2.	1.857
27.	2.29	9.29	1.	.....	.....	11.	1.81	4.83	1.107	.....	12.	2.34	5.43	1.148	.....
28.	2.29	9.4	1.636	1.54	.....	11.	1.825	4.53	1.297	1.2016	12.	2.37	5.68	1.98	1.509
29.	12.	3.	.....	.....	.....	12.	1.825	4.53	1.297	1.2016	12.	2.37	5.68	1.98	1.509
30.	12.	3.	.....	.....	.....	12.	1.825	4.53	1.297	1.2016	12.	2.37	5.68	1.98	1.509
31.	12.	3.	.....	.....	.....	12.	1.825	4.53	1.297	1.2016	12.	2.37	5.68	1.98	1.509
32.	12.	3.	.....	.....	.....	12.	1.825	4.53	1.297	1.2016	12.	2.37	5.68	1.98	1.509
33.	12.	3.	.....	.....	.....	12.	1.825	4.53	1.297	1.2016	12.	2.37	5.68	1.98	1.509
34.	12.	3.	.....	.....	.....	12.	1.825	4.53	1.297	1.2016	12.	2.37	5.68	1.98	1.509
35.	12.	3.	.....	.....	.....	12.	1.825	4.53	1.297	1.2016	12.	2.37	5.68	1.98	1.509
36.	12.	3.	.....	.....	.....	12.	1.825	4.53	1.297	1.2016	12.	2.37	5.68	1.98	1.509
37.	12.	3.	.....	.....	.....	12.	1.825	4.53	1.297	1.2016	12.	2.37	5.68	1.98	1.509
38.	12.	3.	.....	.....	.....	12.	1.825	4.53	1.297	1.2016	12.	2.37	5.68	1.98	1.509
39.	12.	3.	.....	.....	.....	12.	1.825	4.53	1.297	1.2016	12.	2.37	5.68	1.98	1.509
40.	12.	3.	.....	.....	.....	12.	1.825	4.53	1.297	1.2016	12.	2.37	5.68	1.98	1.509
41.	12.	3.	.....	.....	.....	12.	1.825	4.53	1.297	1.2016	12.	2.37	5.68	1.98	1.509
42.	12.	3.	.....	.....	.....	12.	1.825	4.53	1.297	1.2016	12.	2.37	5.68	1.98	1.509
43.	12.	3.	.....	.....	.....	12.	1.825	4.53	1.297	1.2016	12.	2.37	5.68	1.98	1.509
44.	12.	3.	.....	.....	.....	12.	1.825	4.53	1.297	1.2016	12.	2.37	5.68	1.98	1.509
45.	12.	3.	.....	.....	.....	12.	1.825	4.53	1.297	1.2016	12.	2.37	5.68	1.98	1.509
46.	12.	3.	.....	.....	.....	12.	1.825	4.53	1.297	1.2016	12.	2.37	5.68	1.98	1.509
47.	12.	3.	.....	.....	.....	12.	1.825	4.53	1.297	1.2016	12.	2.37	5.68	1.98	1.509
48.	12.	3.	.....	.....	.....	12.	1.825	4.53	1.297	1.2016	12.	2.37	5.68	1.98	1.509
49.	12.	3.	.....	.....	.....	12.	1.825	4.53	1.297	1.2016	12.	2.37	5.68	1.98	1.509
50.	12.	3.	.....	.....	.....	12.	1.825	4.53	1.297	1.2016	12.	2.37	5.68	1.98	1.509
51.	12.	3.	.....	.....	.....	12.	1.825	4.53	1.297	1.2016	12.	2.37	5.68	1.98	1.509
52.	12.	3.	.....	.....	.....	12.	1.825	4.53	1.297	1.2016	12.	2.37	5.68	1.98	1.509
53.	12.	3.	.....	.....	.....	12.	1.825	4.53	1.297	1.2016	12.	2.37	5.68	1.98	1.509
54.	12.	3.	.....	.....	.....	12.	1.825	4.53	1.297	1.2016	12.	2.37	5.68	1.98	1.509
55.	12.	3.	.....	.....	.....	12.	1.825	4.53	1.297	1.2016	12.	2.37	5.68	1.98	1.509
56.	12.	3.	.....	.....	.....	12.	1.825	4.53	1.297	1.2016	12.	2.37	5.68	1.98	1.509
57.	12.	3.	.....	.....	.....	12.	1.825	4.53	1.297	1.2016	12.	2.37	5.68	1.98	1.509
58.	12.	3.	.....	.....	.....	12.	1.825	4.53	1.297	1.2016	12.	2.37	5.68	1.98	1.509
59.	12.	3.	.....	.....	.....	12.	1.825	4.53	1.297	1.2016	12.	2.37	5.68	1.98	1.509
60.	12.	3.	.....	.....	.....	12.	1.825	4.53	1.297	1.2016	12.	2.37	5.68	1.98	1.509
61.	12.	3.	.....	.....	.....	12.	1.825	4.53	1.297	1.2016	12.	2.37	5.68	1.98	1.509
62.	12.	3.	.....	.....	.....	12.	1.825	4.53	1.297	1.2016	12.	2.37	5.68	1.98	1.509
63.	12.	3.	.....	.....	.....	12.	1.825	4.53	1.297	1.2016	12.	2.37	5.68	1.98	1.509
64.	12.	3.	.....	.....	.....	12.	1.825	4.53	1.297	1.2016	12.	2.37	5.68	1.98	1.509
65.	12.	3.	.....	.....	.....	12.	1.825	4.53	1.297	1.2016	12.	2.37	5.68	1.98	1.509
66.	12.	3.	.....	.....	.....	12.	1.825	4.53	1.297	1.2016	12.	2.37	5.68	1.98	1.509
67.	12.	3.	.....	.....	.....	12.	1.825	4.53	1.297	1.2016	12.	2.37	5.68	1.98	1.509
68.	12.	3.	.....	.....	.....	12.	1.825	4.53	1.297	1.2016	12.	2.37	5.68	1.98	1.509
69.	12.	3.	.....	.....	.....	12.	1.825	4.53	1.297	1.2016	12.	2.37	5.68	1.98	1.509
70.	12.	3.	.....	.....	.....	12.	1.825	4.53	1.297	1.2016	12.	2.37	5.68	1.98	1.509
71.	12.	3.	.....	.....	.....	12.	1.825	4.53	1.297	1.2016	12.	2.37	5.68	1.98	1.509
72.	12.	3.	.....	.....	.....	12.	1.825	4.53	1.297	1.2016	12.	2.37	5.68	1.98	1.509
73.	12.	3.	.....	.....	.....	12.	1.825	4.53	1.297	1.2016	12.	2.37	5.68	1.98	1.509
74.	12.	3.	.....	.....	.....	12.	1.825	4.53	1.297	1.2016	12.	2.37	5.68	1.98	1.509
75.	12.	3.	.....	.....	.....	12.	1.825	4.53	1.297	1.2016	12.	2.37	5.68	1.98	1.509
76.	12.	3.	.....	.....	.....	12.	1.825	4.53	1.297	1.2016	12.	2.37	5.68	1.98	1.509
77.	12.	3.	.....	.....	.....	12.	1.825	4.53	1.297	1.2016	12.	2.37	5.68	1.98	1.509
78.	12.	3.	.....	.....	.....	12.	1.825	4.53	1.297	1.2016	12.	2.37	5.68	1.98	1.509
79.	12.	3.	.....	.....	.....	12.	1.825	4.53	1.297	1.2016	12.	2.37	5.68	1.98	1.509
80.	12.	3.	.....	.....	.....	12.	1.825	4.53	1.297	1.2016	12.	2.37	5.68	1.98	1.509
81.	12.	3.	.....	.....	.....	12.	1.825	4.53	1.297	1.2016	12.	2.37	5.68	1.98	1.509
82.	12.	3.	.....	.....	.....	12.	1.825	4.53	1.297	1.2016	12.	2.37	5.68	1.98	1.509
83.	12.	3.	.....	.....	.....	12.	1.825	4.53	1.297	1.2016	12.	2.37	5.68	1.98	1.509
84.	12.	3.	.....	.....	.....	12.	1.825	4.53	1.297	1.2016	12.	2.37	5.68	1.98	1.509
85.	12.	3.	.....	.....	.....	12.	1.825	4.53	1.297	1.2016	12.	2.37	5.68	1.98	1.509
86.	12.	3.	.....	.....	.....	12.	1.825	4.53	1.297	1.2016	12.	2.37	5.68	1.98	1.509
87.	12.	3.	.....	.....	.....	12.	1.825	4.53	1.297	1.2016	12.	2.37	5.68	1.98	1.509
88.	12.	3.	.....	.....	.....	12.	1.825	4.53	1.297	1.2016	12.	2.37	5.68	1.98	1.509
89.	12.	3.	.....	.....	.....	12.	1.825	4.53	1.297	1.2016	12.	2.37	5.68	1.98	1.509
90.	12.	3.	.....	.....	.....	12.	1.825	4.53	1.297	1.2016	12.	2.37	5.68	1.98	1.509
91.	12.	3.	.....	.....	.....	12.	1.825	4.53	1.297	1.2016	12.	2.37	5.68	1.98	1.509
92.	12.	3.	.....	.....	.....	12.	1.825	4.53	1.297	1.2016	12.	2.37	5.68	1.98	1.509
93.	12.	3.	.....	.....	.....	12.	1.825	4.53	1.297	1.2016	12.	2.37	5.68	1.98	1.509
94.	12.	3.	.....	.....	.....	12.	1.825	4.53	1.297	1.2016	12.	2.37			

DISCUSSION OF RESULTS.

All the calves were normal at the start of the work and continued so, except for the one Ayrshire that died in December. The rest of the calves were vigorous and growthy throughout the trial.

Table 1 gives the average daily gains made and the average daily milk, grain and hay fed to each group during each week until six months of age. According to our records very little grain was consumed by any of the calves until the beginning of the fourth week. The Ayrshires did use a little grain the second week and about one-seventh of pound a day during the third week. This is probably a little more grain on the average than would normally be eaten, and appears in our records, no doubt because of nearly three-week's difference in the age of the oldest and youngest Ayrshire; the younger calves getting credit perhaps for some of the grain eaten by the older calf.

During the fourth week all the groups were using grain, the Jerseys the least, and the Ayrshires leading with over one-third of a pound a day. From this time, the amount of grain eaten daily increased steadily. At twelve weeks the Holsteins and Ayrshires were eating two pounds of grain per calf a day. Later the maximum amount of grain allowed per calf was increased to three pounds. The Holsteins were eating this much at six months of age, the Ayrshires were handling two and one-half pounds a piece and very soon took the three pounds. The Jerseys never did consume two pounds a day each freely in the first six months. However they were taking practically that much at the close of the trial.

Scarcely any hay was eaten by any of the calves until the fourth week. The Holsteins seemed to care the least for hay at this time, using during the fourth, fifth and sixth weeks an average of about .1 of a pound a day, against .2 of a pound a day for the Jerseys and nearly .3 of a pound a day for the Ayrshires. From the seventh week on the average amount of hay eaten a day increased rapidly. The Ayrshires consumed the most per day until the sixteenth week. From this time on the Holsteins averaged more hay per head than either of the other groups; and the Jerseys the least. At the end of the feeding trial the Jerseys were consuming from four and a half to five pounds a day on average, against five and a half to six pounds for the Ayrshires and nine to nine and a half pounds for the Holsteins.

The average daily gains of each group increased steadily as the calves grew older and larger. Table 1 gives the average daily gains for each week during the trial of the different groups. The Jerseys made the lowest average gains per day and the Holsteins the largest, while the gains of the Ayrshires were intermediate but showing nearly as large a gain as the Holsteins. This is to be expected when we consider the relative size of the mature animals of the different breeds.

The gains of the individuals of each breed are in relation to the gains of the groups of each breed. The two Holsteins made a daily average of 1.345 pounds and 1.414 pounds respectively. If we look at table II we see that the lowest weekly gain recorded for either of these, with the exception of the first week when one lost four and one-half pounds (while being

TABLE II—*Showing Individual Gains by the Week*

WEEK	HOLSTEIN		JERSEYS				AYRSHIRES			
BIRTH	66.5	89.	56.	55.	63.	5.65 _U	79.	57.5	74.	80.
1.....	4.5	-4.5 ₀	2s.	-1s.	-2 _U .	-1.5 _U	-9. _R	-3.5 _R	0.	-5 _U .
2.....	6.	4.5	5.	5.5	5.	7.5	0	5.5	7.	5.
3.....	3.5	7.	6.	7.	3.	4.5	12.	6.5	8.	3.
4.....	2.5	4.5	5.	5.5	8.	6.	8.	8.	8.	8.
5.....	10.	6.5	5.	8.	8.	8.	7.	10.	8.	7.
6.....	9.	12.5	4.	7.	5.	10.	6.	8.5	6.	9.
7.....	9.	11.5	5.	9.5	3.	5.5	5.	8.5	6.	11.
8.....	10.	13.	-1.	6.	11.	3.5	9.	11.	12.	12.
9.....	12.	12.	3.	-1.5	8.	10.	19.	10.	5.	8.
10.....	8.	10.5	6.	9.	11.	7.	10.	14.	5.5	8.
11.....	13.	5.5	7.	9.	10.	10.	11.	8.	8.5	7.
12.....	8.	17.	6.	9.	6.5	6.5	8.	11.	11.	8.
13.....	6.	8.5	5.	12.	5.	4.5	7.	12.	7.	9.
14.....	6.	4.5	7.	3.5	13.5	5.	12.	8.	0.	10.
15.....	10.	11.	7.	2.5	11.	8.	10.	10.	14.	7.
16.....	14.	6.5	0.	10.	7.	10.	5.	7.	3.	12.
17.....	8.	12.5	10.	8.	7.	4.	11.	9.	12.	14.
18.....	10.	10.	2.	5.	3.	8.	14.	16.	10.	5.
19.....	16.	13.	6.	5.	7.	3.	4.	14.	14.	16.
20.....	11.	15.	6.	4.	10.	6.	7.	14.	3.	7.
21.....	16*	10*	5.	5.	5.	3.	12.	20.	13*	16*
22.....	4.	18.	8.	9.	13.	9.	8.	18*	5.	7.
23.....	10.	5.	7.	6.	4.	13.	11.	2.	6.	10.
24.....	19.	16.	10.	13.	7*	7.	27*	10.	14.	5.
25.....	4.	13.	9.	11.	1.	10*	0.	10.	7.	15.
26.....	14s.	30.	10 _R .	11.5 _R	14 _R .	6 _R .	11 _U .	10 _U .	13s.	2.5
27.....	10.	30.	10.	11.	14.	6.	11.	10.	13.	11 5 _A
TOTAL ..	243.5	256.	145.	180.5	184.	170.5	243.	262.5	206.	228.

*—Access to water before weighting.

R—Eight Day's gain.

1—Weighed at 20 days.

U—Five day's gain.

0—Three day's gain.

A—Two day's gain.

S—Six day's gain.

taught to drink), was two and one-half pounds during the fourth week. The most gain recorded is nineteen pounds during the twenty-fourth week for the same calf.

The four Ayrshires made average gains of 1.45 lbs., 1.3425 lbs., 1.25 lbs., and 1.138 lbs., respectively. Two made gains equal to the two Holsteins, the other two making gains that were lower. As with Holsteins, Table II shows us that one Ayrshire lost weight while learning to drink and another held its own. During the fourteenth week one registered no gain. Another showed no gain on two different weeks, the second and the twenty-fifth. The highest gain recorded was 27 pounds during the twenty-fourth week. As this was followed by no gain the next week some of the gain was no doubt due to a fill, the calf having had access to water before weighing, which was not the usual rule.

The four Jerseys gained .797 pounds, .99 pounds, 1.016 pounds, and .942 pounds. These calves were all healthy and thrifty. Only one gained a pound a day, although two others were very close to that mark. The three that made the highest gains were all bulls, while the one heifer in this group averaged .797 pound a day. She was healthy and vigorous at all times and her gains were steady. Two of the Jerseys lost in weight during the time they were being taught to drink. At two other weighings a calf registered a loss each time. The highest gain recorded was 13.5 pounds during the fourteenth week.

Table II shows the gains of the individuals of each breed for each week during the trial. This table tells us that the Holsteins averaged

TABLE III—Showing Average Daily Gain; Grain to Gain;
Hay to Gain by Four-Week Periods

PERIOD	HOLSTEIN						JERSEYS						AYRSHIRES						ALL BREEDS					
	Ave.		Grain		Hay		Ave.		Grain		Hay		Ave.		Grain		Hay		Ave.		Grain		Hay	
	Gain	1 lb.to	Daily	Gain	1 lb.to	Daily	Gain	1 lb.to	Daily	Gain	1 lb.to	Daily	Gain	1 lb.to	Daily	Gain	1 lb.to	Daily	Gain	1 lb.to	Daily	Gain	1 lb.to	Daily
1st. 4 Wks.	.585	.036	.0006	.1515	.026	.674	.0225	.033	.009	.0133	.728	.1427	.196	.045	.0618	.678	.0743	.0917	.0519	.0352				
2nd. 4 Wks.	1.566	.776	.5	.214	.138	.87	.6425	.738	.238	.333	1.214	.89	.733	.46	.38	1.144	.6235	.6885	.3418	.3128				
3rd. 4 Wks.	1.473	1.93	1.31	1.587	1.08	1.04	1.212	1.16	1.419	1.36	1.357	1.7975	1.82	3.034	2.233	1.253	1.59	1.254	1.604	1.66				
4th 4 Wks.	1.258	2.	1.59	4.14	3.29	.991	1.4625	1.47	3.38	3.8	1.187	1.93	1.62	3.74	3.16	1.1228	1.767	1.564	3.676	3.24				
5th. 4 Wks.	1.66	2.16	1.3	6.375	3.33	.812	1.65	2.03	3.465	4.25	1.517	1.985	1.3	4.2375	2.8	1.2636	1.866	1.592	4.356	3.536				
6th. 4 Wks.	1.803	2.46	1.375	8.77	4.86	1.107	1.634	1.467	4.565	4.1	1.637	2.055	1.22	5.1	3.02	1.478	1.97	1.35	5.62	3.82				
Last 2 Wks.	1.34	2.64	1.97	9.34	7.	1.2016	1.817	1.51	4.68	3.89	1.509	2.355	1.56	5.555	3.68	1.352	2.2	1.62	5.96	4.43				
26 Wks.	1.379	1.61	1.171	3.82	2.765	.936	1.173	1.252	2.33	2.49	1.295	1.533	1.183	2.97	2.296	1.169	1.404	1.21	2.884	2.47				

eight weeks; the Ayrshires six and one-fourth weeks; and the Jerseys thirteen and one-half weeks during which they gained less than one pound a day. According to this table the relation between birth weights and total gains is not constant. The calf that made the greatest gains was an Ayrshire and was one of four lightest calves at birth. The largest Ayrshire at birth was third in the amount of gains made, while the lightest Ayrshire at birth made the most gains. The largest Jersey at birth made the greatest gain, but the smallest Jersey at birth was second in amount of gains. A heifer and a bull which at birth weighed within one-half pound of each other, at six months varied twenty-five pounds, the heifer being the lightest. The two Holsteins stood in the same relation as to gain as they did to weight at birth.

Table IV gives the average daily, weekly and total gains of the calves in each group and of all the calves for each successive four-week's period and for the entire twenty-six weeks.

The average amount of hay and grain used daily by the individuals of each group and of all groups and the amount of grain and hay required for each pound gain during each successive four-weeks period is given in Table III. It is indicative of the part milk plays in the food of a young calf when we note how in each successive period the amount of hay or grain

TABLE IV—*Showing Average Gain by Four Week-Periods*

	HOLSTEINS			JERSEYS			AYRSHIRES			ALL BREEDS		
	Daily	Wkly.	Total	Daily	Wkly.	Total	Daily	Wkly.	Total	Daily	Wkly.	Total
1st. 4 Weeks	.585	4.095	29.5 d.	.674	4.718	26.5 d.	.728	5.094	20.375	.6778	4.7446	27.7d.
2nd. 4 Weeks	1.555	10.875	17.5	.87	6.094	16.875	1.214	8.5	34.	1.144	8.008	18.77
3rd. 4 Weeks	1.473	10.312	43.5	1.04	7.28	24.375	1.357	9.5	38.	1.253	8.77	32.05
4th. 4 Weeks	1.258	8.87	41.25	.991	6.937	29.125	1.187	8.31	33.25	1.123	7.86	35.1
5th. 4 Weeks	1.66	11.625	35.25	.812	5.687	27.75	1.517	10.625	42.5	1.264	8.845	31.4
6th. 4 Weeks	1.803	12.625	46.5	1.107	7.75	22.75	1.687	11.81	47.25	1.478	10.346	35.4
Last 2 Weeks	1.34	9.38	50.5	1.2016	8.41	31.	1.509	10.566	13 1/4 d.	1.3522	9.4654	41.5
Whole 26 Wks.	1.379	9.653	11 1/2 d.	.936	6.552	15 d.	1.295	9.065	20.	1.169	8.18	13.6d.
			181 d.			181 1/2 d.			181 1/4 d.			181 1/2 d.
			249.75			17.0			234.87			211.9

to the pound of gain in weight is increased. This shows that the young calf depends entirely on milk at the start of its life, and, as it grows older, depends more and more on the other food stuffs. If these averages of the grain and hay eaten in relation to the gain made or in toto are read over carefully we will notice an increasing amount of each used by the calf as it grows in age and size. We will also notice that the larger breeds while using more grains in all, use less to the pound of gain. The amount of hay used in relation to the average gain bears similar relation as the grain.

The Holsteins, however, used the most hay, the Jerseys next, and the Ayrshires the least. The calves of the two larger breeds consumed a greater total amount of hay on the average than did the Jerseys.

Table V gives the individual total gains of the calves in each group and also the total gain and average gain of each group. The largest total gain was made by an Ayrshire. Two Holsteins made gains that were intermediate to the largest and next largest Ayrshire gains. If we average the gains of these two Ayrshires we find them making an average of 252.7 pounds or 3 pounds more than the average of the two Holsteins. One Ayrshire made a gain of 206 pounds. This calf at birth weighed 74 pounds and it is hard to tell just where it failed to keep up with the others. It was perhaps less thrifty than the others for its coat was rough and general

appearance not of the best the last three months. The Ayrshire gaining the most was lighter by almost 17 pounds at birth than the next lightest Ayrshire. Yet it weighed within two pounds of the heaviest Ayrshire at six months of age. It was only one and one-half pounds heavier than two of the Jerseys at birth yet out-weighed them at six months by 93 pounds and 34 pounds.

None of the four Jerseys made gains equal to the calves of the other breeds. This was not due to a lack of vigor, as all were vigorous and thrifty.

According to Table V the Holsteins ate on an average more at six months of age than the Ayrshires or Jerseys, though the Ayrshires handled very nearly as much. The grain to the pound of gain was very similar in Holsteins and Ayrshires, the former requiring .012 of a pound less of grain to the pound of gain. The Jerseys used .07 of a pound more of grain to one pound gain than the Ayrshires. The grain fed to three Holstein or Ayrshire calves would feed four Jersey calves.

The Holsteins also ate more hay on the average than other breeds. The hay required for four Holstein calves until six months of age would furnish feed for six and one half Jerseys, or for five Ayrshires.

The total amount of grain and of hay eaten was less for the Jerseys, and most for the Holsteins with Ayrshires intermediate in the amount they used. The Holsteins used less grain to one pound of gain, with Ayrshires using very nearly the same and the Jerseys the most. However, in this trial the Jerseys used less hay to the pound of gain than did the Holsteins, but .2 of a pound more than did the Ayrshires.

SUMMARY.

1. The gains in weight are in keeping with mature weights of the animal.
2. The gain of any one week is not an index to the average gain.
3. A calf depends entirely on milk for its food at first and should have it.
4. Calves will not eat much grain or hay before the third or fourth week.
5. We cannot expect to make as large average gains with the smaller breeds as with the larger breeds under the same condition.
6. The amount of hay and grain used in proportion to the weight of the animal and in toto increases steadily as the calf grows older.
7. The larger breeds are apt to show a greater amount of gain to a certain amount of grain or hay than the smaller breeds.
8. The larger breeds will use a greater total amount of hay or grain than the smaller breeds.
9. Three Holsteins, or four Ayrshires, or five Jerseys used a total of one ton of hay at six months of age.
10. Seven Holsteins, or seven Ayrshires or nine Jerseys used a total of one ton of grain at six months of age.

NOTES ON CALF RAISING.

Selecting Calves to Raise.

It is questionable if one dealing with the dairy breeds, pure-bred or grade, should attempt to raise every calf dropped. There is an occasional runt or a calf that is unthrifty from birth. This calf, unless of some special blood line, is not desirable to grow out, and it is doubtful if it should be used for breeding purposes at all. A runt calf at the station, as large at birth as other calves of the same breed, failed to make satisfactory gains at any time. At six months of age it was 30 pounds to 70 pounds smaller than normal calves of the same breed.

The Ohio Station reports feeding skimmed milk to an unthrifty calf until one year of age. This heifer was 100 pounds under average weight

TABLE V—Showing Total and Average Gains. Also Grain and Hay Eaten

Breed	Number Animals	Gains.		Grain		Hay	
		Individual.	Total	Average	Total	Average	Total
Holsteins	2	256.	243.5	128.0	499.5	249.75	585.
Ayrshires	4	262.5	243.	206.	939.5	234.9	1111.5
Jerseys	4	184.	180.5	170.5	680.	170.	851.5
All	10	.....	.....	211.9	211.9	2548.	2548.

Holsteins [249.75]—Jerseys [170]—79.75 pounds more gain on average favor Holsteins.
 Holsteins [249.75]—Ayrshires [234.9]—14.85 pounds more gain on average favor of Holsteins.
 Ayrshires [234.9]—Jerseys [170]—64.9 pounds more gain on average favor of Ayrshires.

Holsteins [692.5]—Jerseys [212.9]—79.6 pounds less grain on average favor of Jerseys.
 Holsteins [292.5]—Ayrshires [277.87]—14.63 pounds less grain on average favor of Ayrshires.
 Ayrshires [277.87]—Jerseys [212.9]—64.97 pounds less grain on average favor of Jerseys.

Holsteins [690.5]—Jerseys [423.56]—266.94 pounds less hay on average favor of Jerseys.
 Holsteins [690.5]—Ayrshires [539.44]—151.06 pounds less hay on average favor of Ayrshires.
 Ayrshires [539.44]—Jerseys [423.56]—115.88 pounds less hay on average favor of Jerseys.

of other calves and freshened four months later than the average. It gave birth to a deformed calf and was of no value as a milker.

In grade dairy herds it is advisable to kill all bull calves at birth. Scarcely ever at any later date will they sell for enough to cover the cost of growing. It is never advisable to sell them as breeding stock. Only grade heifers from the best cows and sired by purebred bulls should be raised. A heifer from a nondescript bull and a grade cow is a gamble, she may prove a good milker, but chances are against it. Breed the best cows to a good purebred bull, raise the heifer calves from this mating, and improve your herd.

In pure-bred herds grow out all thrifty heifers, but cull closely when they freshen or after milking a year. It is not advisable to raise all purebred bulls. A much better plan is to select the thrifty, well-put-up bull calves from the cows of most merit and, if possible, from cows with a record of production, and grow these out so they will mature into first-class animals.

Do not attempt to grow more calves than you can properly attend to. Grow a few, grow them exceptionally well and your profits will be as much and labor less.

CARE OF DAM.

A calf that is strong and vigorous at birth is more apt to result in a thrifty animal than one that is weak at birth. The condition of the calf at birth is influenced by the feed given the dam while carrying the calf. We must therefore commence feeding the future calf some months previous to its birth by choosing the proper food for the dam. The Wisconsin Station has shown that the proper selection of roughage and grain for the dam determines the vigor and development of the calf she is carrying. They have proved that a ration derived wholly from either the wheat or the oat plant is deficient and will not furnish a ration which will bring about normal growth and reproduction. When the oat ration was modified by substituting for the oat straw, a legume hay, normal reproduction followed. This addition to the wheat ration was not sufficient. However, by adding both corn grain and alfalfa hay to the wheat ration a normal calf resulted. The results at that station have proved that the pregnant cow must receive a ration that contains carbohydrates, flesh forming proteids of the right kind, ash in sufficient amount, and the two essential vitamins, and also contain no toxic substances in sufficient quantities to be injurious.

We can insure successful reproduction by furnishing our breeding stock with some of the legume hays as alfalfa, clover, cow pea, or soy-bean hay; and by the use of corn or sorghum silage, or good pasture grasses as our bulky feeds. In addition to this feed we should give her a grain ration of four or more pounds a day, depending upon the amount of milk and butter fat she is producing and the stage of pregnancy. We can use to form this ration such grains as corn, in the form of corn meal or corn and cob meal, bran, oats or oat meal, linseed meal, soy-bean meal and cottonseed meal.

Always include a legume hay in your rough feed and build your grain ration with corn as a foundation, and feed liberally and your results will be successful. Use cottonseed meal, especially at the last, with a restraining hand. Keep the future mother gaining at all times; and have her dry the last six or eight weeks. Reduce her grain ration the last week or ten days and let it consist mostly of cooling feeds as oats or bran. Keep her away from animals in heat or young stock. When due to freshen place her in a clean grass lot or in a light, freshly cleaned, and well bedded box stall where she will be free from any disturbance. Leave her alone, except for an occasional visit of an attendant, and let nature work. Do not be too eager to help nature, as too early an interference

is as bad as one too long delayed. Give her plenty of time to calve naturally, twelve to twenty-four hours, before you interfere.

THE YOUNG CALF.

Teaching to Drink.

Leave the young calf with the mother for a day and let it suck for two days. The first milk or colstrum is necessary to the young calf to purge out its system and start it out properly.

In teaching the calf to drink, allow about 12 hours to pass after the last sucking, then take about 4 pounds or two quarts of its mother's milk in a pail that is clean and sweet, push the calf into a corner, straddle its neck, hold the pail in one hand, and, letting the calf suck two fingers of the other hand, gradually draw its muzzle into the milk. As soon as it gets a taste of the milk your trouble is usually over, although occasionally a stubborn calf will require more time and much patience.

If left with the mother longer than two days the calf is harder to teach to drink, growing more so the longer it sucks. Only in event the calf is rather weak will it pay to leave it with the dam a longer time.

FEEDING MILK.

Milk is without doubt the best food for the young calf. It is vital for the first four or five days, as without it the young calf will die. It is necessary for proper development for about two or three weeks and should be fed if possible for at least six months. An English writer, J. A. Voelcher, makes the following statement which will be supported by any practical stockman. He says, "The influence of early feeding of calves has an important bearing on the after development and a good start is very essential." The feeding of whole milk, the dam's milk for a week and of herd milk the remainder of the time, for three or four weeks is preferable. A writer states that the development of calves on skim-milk the first three months was not as satisfactory as those on whole milk. Some breeders feed whole milk to their pure-bred calves for six or eight months because of the superior development they claim to attain.

However, under practical circumstances the whole milk cannot be profitably fed over four weeks. Our trials, as reported in this bulletin, show that satisfactory results can be obtained following the above method. C. F. Curtiss, at the Iowa Station, reporting on the results of feeding whole milk against skim-milk says that, while the weight favored the whole milk calves, the cost per pound, the condition, thrift and general appearance; and growth when placed on pasture and grain were in favor of the skim-milk calf. Other experiment station workers have confirmed this report and show that skim-milk calves are successfully reared at about one-third the cost of whole milk calves. C. F. Doane and T. M. Price, in a Maryland Bulletin, report that skim-milk is as digestible as whole milk.

The amount of skim-milk fed is perhaps determined by the size and condition of the calf in question and the amount of milk available. In the trials reported in this bulletin we did not feed over twelve pounds a day. This summer, 1921, we are feeding calves three to six months of age twenty pounds a day in two feeds a day; and are receiving gains of from 10 pounds to 15 pounds per week. The calves are brought to this amount very gradually so as not to throw them off their feed or cause digestive troubles. If it is not possible to separate the milk and feed while yet warm, or if the hand skimming system of creaming is used, it is perhaps advisable to warm the skim-milk to about 95 degrees or 100 degrees F. before feeding. Especially is this true in colder weather and during the first two or three months. Pan skimmed milk is probably superior to separator skimmed milk as a feed as it contains slightly more fat.

Grain for Calves.

According to our tables a young calf will nose over grain about the third week and will be eating an appreciable amount by the fourth week. When feeding skimmed milk, the effort is to replace the fat in the milk by the grain fed.

At the Iowa Station a trial of self-feeders for calves was carried on under direction of Professor McCandlish, where six feeds were available; viz: shelled corn, cracked corn, whole oats, ground oats, oil meal, and wheat bran. When the calves were receiving whole milk they preferred oats to the corn and ate whole oats and ground oats in about equal amounts. However, when the skim-milk was fed, the corn was preferred and whole corn was preferred to cracked corn, and at six months of age the calves had eaten six times as much corn as all other concentrates combined. C. F. Curtiss summing up feeding trials of different concentrates for calves on skim-milk, says: "Greater influence is exerted by fats and carbohydrates than by proteins and nitrogenous feeds are not needed in skimmilk ration but fat or its equivalent is needed." The Kansas, Nebraska, Virginia, and Kentucky stations report tests with calves that confirm this statement. Shelled corn was preferable to other feeds at all stations. With calves intended for dairy purposes it is well to use a grain, as oats, linseed meal, soy-bean meal, or bran with the corn in order to furnish more muscle building material. Bran and oats are comparable; though bran is perhaps more laxative. Cottonseed meal should not be fed to young calves. There is something toxic in its nature that is injurious and often fatal to the young calf. At North Carolina, F. E. Emery fed three calves on cottonseed meal and skim-milk and in one to one and a half months all died. At Pennsylvania Station, T. S. Hunt fed three calves on cottonseed meal and skim-milk and two of them died. Just where the cause of the trouble lies is not known. The "safety first" idea should be used and no cottonseed meal fed before six months of age, and only lightly until a year of age.

Grain feeds are best fed dry and not mixed with the milk.

Our trials with molasses at the station the past winter indicate that it can be used in the grain ration as a substitute for corn with calves over two months of age especially with oats forming half the grain ration.

The amount of grain that a calf will use as shown by our test varies with the age and size of the individual. It is a safe rule to allow them all the grain they desire up to two pounds a piece a day in addition to the skimmilk. Some larger calves may use more than that amount economically. Keep the grain in a convenient feed box until the calf is feeding freely and then endeavor to feed the grain so that the calf can eat it directly after drinking its milk. This method will do a great deal to overcome the tendency to suck each other.

Hay for Calves.

Reference to Table I of this bulletin shows us that the calves were nibbling at the hay when two weeks of age and were consuming a fair quantity at from five to six weeks of age. That coarse fodder is essential to the life of the calf was shown by E. Davenport, of the Illinois Station. In his work he fed four calves on rations of skim-milk and grain. The calves on skim-milk alone used as high as 70 pounds of milk a day, while those on skim-milk and grain ate one-half bushel of grain at five months of age. Neither ration satisfied their hunger. The calves did not chew their cud and eventually lost their appetite. Given straw or hay they ate it greedily, chewed cud for the first time, and recovered rapidly; without it they sickened and died.

The best hays available should be used for the young calf. A second cutting of clover or alfalfa hay is fine. Fine stemmed cowpea or soy-bean hay is good. A good quality of mixed hay is all right. Keep this hay before the calf at all times, in small quantities at first, changing frequently

in order that it may be sweet and clean, and always allowing the calves all they will eat. Do not attempt to raise a calf and use such rough feeds as oat straw or cottonseed hulls. You will be disappointed as neither will give the growth desired in a young calf. If necessary to use them; you must make up for their lack of nutriment by the use of more grain. This means more expense and also poorer results, as it is liable to result in an undersized and pot bellied calf.

Calf Meals for Calves.

Some proprietary calf meals are on the market, the purpose of which is to replace skimmilk in the ration. Several Experiment Stations have tried these out, along with home mixed calf meal and all report similar results. Dr. Lindsey in Mass. Station Bulletin 164, reports as follows: "Calf meals purchased or prepared at home will take the place of a considerable amount of whole or skimmilk and not interfere with normal growth. It is not advisable to rear calves during the first four months without daily use of three to five quarts of skim-milk. A too early attempt to accustom a calf to an exclusive diet of calf meal is likely to produce digestive disturbances that may affect the health in after life. Holstein and Ayrshire calves as a rule are better able to utilize prepared feeds than are Jersey or Guernsey calves."

At the Indiana Station Blatchford's calf meal, a home mixed meal, and skim-milk were fed against each other. Ten calves on skim-milk made the largest gains at least cost per lb. Calves on the home-mixed ration were next, while those on Blatchford's calf feed gained least and cost most per pound of gain. The calves on the meals had whole milk in decreasing quantities until the fifth week and some for ten to nineteen weeks and one until six months of age. Trouble was experienced in putting them on the meal ration, digestive disturbances taking place. They conclude that the price of ready prepared calf meal is prohibitive, and that a home-mixed calf meal can be made that is acceptable. They advise its use only in case that the chief product sold is whole milk. Then the calves at six months of age will not be developed as will the milk fed calves.

Water for Calves.

The first few days the young calf will not want any water other than what it gets in its milk. At a week or ten days, when it starts nosing the hay and grain, some water will be acceptable and should be allowed. Always place the water before the young calf after feeding milk, making sure that it is not cold to chill the young calf, and no digestive disturbance will result. After this keep a supply of fresh, pure water in a clean receptacle within reach of the calf always.

Salt.

Salt is necessary if animals develop properly. The system needs it in carrying on its functions. The young calf gets a liberal amount of mineral from its milk, but will lick at salt at a very early age. Place salt within reach of the young calf and you will be surprised how soon it will lick it.

Pasture.

We are not ready to state conclusively at what age young calves should be placed on pasture. Stockmen express different opinions. We do know that as good calves can be grown in the dry lot by the use of plenty of good hay as can when they have the run of the pasture, and our results so far at the station show slightly larger gains and better finished calves in the dry lot up till six months. In any instance the calf pasture should

be separate from that pasture in which the older cattle are running. There should be, also, a shed or calf barn accessible to the calves where they can seek shelter from storm, cold winds, or the hot sun.

The Calf Barn.

The calf barn should be so constructed that the sun can gain access to every part of it at some time during the day. The side or sides toward the sun should be well supplied with windows, to furnish light and allow the sun to enter. These windows, if hung at the bottom on hinges, so that they will swing in, opening into a kind of a casing will furnish ventilation and yet the cold air will not strike directly on the calves. This barn should be so constructed that it can be divided off into small pens if occasion requires. A young calf will be easier cared for and will thrive better if it can be placed in a small pen by itself until a month of age. After this age not more than four or five calves should be placed in the same pen, and these should be as nearly of an age and size as possible. See that each pen is supplied with a convenient hay rack, with a grain feed box and also with stanchions to hold the calves while feeding their milk. The grain feed box can be built directly in front of the stanchions and the calves fed their grain at once after having had their milk.

Clean this stable at regular intervals and do not have these intervals too long. See that the calves are always supplied with a clean, dry bed. A coat of white wash, spring and fall, will aid in keeping the house free from disease, and make it lighter and offer some assurance that it will be kept clean.

Dehorning.

A great many practical stockmen and breeders prefer hornless animals. The best time to dehorn a calf is at one week or ten days of age when the young horn or button is just showing. At this time clip the hair from around this button until you have a spot about one inch in diameter, the button in the center. Now take a stick of caustic potash (which can be had at nearly every drug store), wet the end in water and rub on this button until it becomes quite red, almost bleeding. Make sure that you touch all the button as if any part of it is missed a stub horn will result. Also do not rub out on the skin bordering the button more than is necessary as it will cause too much of a sore. A piece of paper around the stick of potash will protect the operator's fingers.

This is the method followed at the station and is preferable to any other.

Diseases of the Young Calf.

The most troublesome disease of the young calf is scours. There are two forms of this disease. The most common form is non-contagious and is caused by some condition which throws the calf's digestive system out of order. In this disease the bowel discharges are normal in color at first but so soft and watery that they soon discolor the tail of the young calf. The calf becomes dull, listless, gaunted and loses its appetite. Some things to observe in seeking to prevent this form of scours are: do not overfeed the young calf; be regular in your time of feeding; use the same cow's (preferably the dam's) milk at each feeding, and feed this before it has had time to cool; make certain that the feed buckets are clean and sweet; keep the calf's stall dry and well bedded; keep the calf out of drafts and do not expose to cold winds or rains.

Should the calf contract scours the first thing to do is to reduce its milk at least one half. Often it is desirable to miss a feed altogether, and feed a reduced ration afterwards, gradually bringing the calf back to the full ration. Many cases of scours will give away to this treatment. Should this not be successful, two or three ounces of castor oil, depending on the

size of the calf, in a little milk may be given. The milk ration is reduced at the same time.

Formalin used in the proportion of three drops of formalin to one-half pound or one pint of the reduced ration is also recommended as a treatment for scours.

The other forms of scours, called white scours, sometimes occurs. It is very contagious. It usually occurs within two or three days after birth and is almost always fatal. The young calf is dull, listless, weak and shrunken and breathing is more or less difficult. The bowel discharges are profuse, yellowish white and very offensive. Prevention is about the only remedy. Prevention consists, first in a thorough disinfection of the premises, where this disease has made its appearance. Also, as the disease gains entrance to the young calf's system through the umbilical cord, the external genital organs of the cow before birth and of the navel cord of the calf immediately after birth should be washed with an antiseptic solution. A carbolic acid solution, ($\frac{1}{2}$ oz. to a quart of water) is recommended. The navel cord should also be tied with a cord taken from a strong carbolic acid solution, and then washed with a potassium iodide solution made of iodine one-half dram; iodide of potassium, one-half dram; water, one quart. When dry cover the cord with a coating of tar containing 1 per cent of iodine. This is the method recommended by the Bureau of Animal Industry of the United States.

The stall in which the young calf is born should be prepared by cleaning out, thoroughly disinfecting and then supplying with fresh bedding, which should be continually removed to insure its being fresh when the calf is dropped.

It is well to enlist the aid of a veterinarian when this form of scours appears.

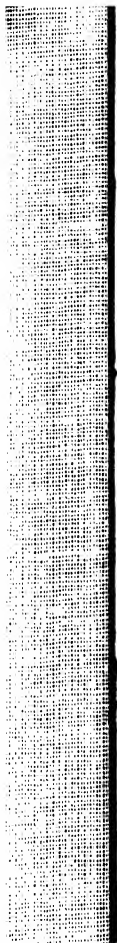
Another disease that has caused considerable trouble with young calves is Hemorrhagic Septicemia. This disease is evidenced by a drooping condition of the calf, more or less diarrhea, perhaps a slight cough, a continued emaciation when the disease becomes chronic, and a general weakness. The disease calls for a separation of the sick animal which usually dies within a few days, and a thorough disinfection of the stable. A vaccine is on the market which is more or less successful in preventing the disease, and which, although not recommended as a cure, can at least be recommended as an insurance.

Worms may at times give trouble with calves that are running on pasture. The worms cause emaciation, diarrhea, a general weakening and lack of resistance to unfavorable conditions. The appetite usually remains good.

Preventative measures as burning and abandoning or cultivating the pasture are recommended. It is claimed that such measures will free the pasture in eighteen months if no material from infested lands is washed onto the treated pasture.

Calves which were evidently infested with worms at the college seemed to respond to the following treatment: Five grams of copper sulphate was dissolved in one-half a pint of water. The calf was allowed no feed for twenty-four hours and was then drenched with this solution. No feed was fed for three hours after dosing. In ten days the treatment was repeated and, if necessary, the third time in another ten days.

Another solution used with about the same result and in the same way was five grams of copper sulphate and five grams of tobacco dust dissolved by boiling in one-half pint of water.



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